

REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 41 to 67 and 76 to 78 are under active examination.

Claim Rejections under 35 USC § 103

1&2. Examiner has rejected claims 41-58, 60-67, 76 and 77 as being unpatentable over Harris et al. (WO 00/57022 - cited previously) in view of Still et al. (US 7,166,560).

Examiner acknowledged that Harris et al. fails to teach a process wherein a solid polymer capable of being converted by hydrolysis into one or more organic acids is dispersed in a treatment fluid, as required in independent claim 41. However, Examiner argued that it would be obvious to one having ordinary skill in the art to substitute the ester used in Harris et al. by a solid polymer taught by Still et al. Applicant respectfully disagrees with this assertion.

Harris et al. and Still et al. relate to fundamentally different techniques and so they are not compatible teachings

Harris et al. aims to provide simple and effective methods for the removal of filter cakes over long horizontal intervals (page 2 lines 22 to 23). Harris et al. teaches the use of a combination of a liquid ester and a polymer breaker for achieving this object. The liquid ester hydrolyzes to produce an organic acid to dissolve acid soluble material and the polymer breaker degrades polymeric material (see, for example, claim 1).

In contrast, Still et al. is concerned not with removal of filter cakes, but with acid fracturing methods. The aim of an acid fracturing treatment is to use acid to etch the faces of a rock fracture, deliberately created by pressurizing the system, so that when the pressure is released (or falls to below the fracture pressure, which typically happens within several minutes as acid reacts and fluid leaks off into the formation) and the fracture closes, the etched fracture faces retain highly permeable channels which remain open and enhance the flow rate.

It is important to emphasize that filter cake disruption methods and acid fracturing methods are fundamentally different techniques and, as would be known by one skilled in the art, are carried out using completely different principles.

For example, the two techniques differ in where, and how, the reactive material needs to be delivered. In an acid fracturing technique acid is required far from the wellbore (see for example Still et al., which discloses at column 1 lines 13 to 14 that their invention relates “to a

method of generating acids in situ far from the wellbore...”). In contrast, filter cakes are located within the wellbore. Therefore a filter cake clean-up method is to supply filter-cake disrupting substances, such as acids, within the wellbore. Further, acid fracturing is an acid treatment process that is carried out exclusively at a high pressure that is above formation fracture pressure, i.e. a pressure that is sufficient to fracture the rock formation. In contrast, filter cake clean-up treatments are almost always conducted at a pressure that is well below the formation fracture pressure.

One of ordinary skill in the art would therefore immediately recognize that when a treatment fluid is proposed for use in a filter cake disruption technique, then the aim is to deliver reactive materials to the wellbore typically under relatively low pressures. In contrast, when a treatment fluid is proposed for use in an acid fracturing technique, then the aim is to deliver reactive materials far from the wellbore at high pressure. As such one of ordinary skill in the art would not contemplate combining Harris et al. with Still et al. because entirely different criteria apply when designing fluids suitable for use in filter cake disruption and acid fracturing, respectively.

Disclosure of solid polymers in Still et al. would not motivate one of ordinary skill in the art to use solid polymers for disrupting filter cake

As noted above, one of ordinary skill in the art would not contemplate modifying the fluid cake treatment process of Harris et al. on the basis of features disclosed in connection with an acid fracturing process. Notwithstanding this fact, the general teaching of Still et al. would mean that a skilled worker would not be motivated to apply the solid polymers disclosed therein in a filter cake disruption process.

The process of Still et al. is clearly intended to be carried out at rather high temperatures. For example, Still et al. regards “low temperatures” to be below about 135 °C (column 5 line 19) and provides examples in the temperature range of 121 to 149 °C (column 10, Table 1). At temperatures below about 135 °C “accelerants” are proposed for use in conjunction with the solid polymers, since the hydrolysis rate of the solid polymers is apparently too slow, even bearing in mind that hydrolysis is not required until the material is already far from the wellbore (see column 5 lines 18 to 22).

The treatment fluids of Harris et al., on the other hand, are designed to be used primarily in the range of 10 °C to 120 °C (page 6 line 28 to page 7 line 12) and must generate acid in the wellbore (specifically, in the vicinity of the filter cake). One of ordinary skill in the art would expect therefore that if the hydrolysis rate of the solid polymers of Still et al. is not sufficient even at temperatures of about 135 °C when high pressure acid fracturing is carried out to deliver acid far from the wellbore, then it would certainly be insufficient at the lower temperatures and pressures associated with filter cake disruption procedures and where acid is required within the wellbore itself (not “far from the wellbore” as in acid fracturing). There is thus no motivation to try using the solid polymers of Still et al. in place of the liquid esters already taught by Harris et al.

It should also be borne in mind that since the method of Harris et al. is directed at combined acidizing and polymer breaking, this places further limitations on the temperature range at which the method can be carried out. In particular, the temperature must be permissive for the use of either enzyme polymer breakers or oxidizing polymer breakers, which are the polymer breaker components disclosed in Harris et al.

In that context, Harris et al. clearly indicates (at page 11 lines 4 to 17) that temperature is an important determinant of the enzyme components used in the formulation. For example, at 60°C both starch-breaking and xanthan-breaking enzymes may be used, but at 110°C only a starch-breaking enzyme can be used (the reason is that the xanthan-breaking enzyme is inactivated at temperatures above about 75°C).

Of the enzymes commonly used in the treatment of underground formations, the most temperature-tolerant are generally certain amylases used to degrade starch; these are active up to a maximum of about 115 °C. The majority of other enzymes may only be usefully employed at temperatures well below 115 °C, and may typically have a maximum operating temperature in the range of 10 to 75 °C.

Similarly many oxidizing polymer breakers find utility only at much lower temperatures than the temperatures contemplated in the method of Still et al.. For example, at page 9, lines 9 to 10 of Harris et al. it is disclosed that peracids are more effective oxidants than peroxides, particularly in the temperature range 25 to 80°C.

It would therefore be understood by one of ordinary skill in the art that, in practice, the method of Harris et al. should be carried out at relatively low temperatures (certainly well below that 135 °C that Still et al. already regards as being a low temperature for acid fracturing). With that in mind, it becomes still more evident that the solid polymers of Still et al. would not reasonably have been regarded as being suitable for use in conjunction with the Harris et al. process. The skilled person would have expected the hydrolysis rate of the Still et al. solid polymers to be simply too slow under the normal conditions applicable in the Harris et al. process.

Incidentally, while Still also proposes increasing the rate of acid generation from solid polymers by incorporating certain agents which accelerate their hydrolysis, particularly hydroxides, there is still no motivation to incorporate this solid polymer and “accelerant” combination into a treatment fluid for carrying out filter cake disruption. This is because these accelerant agents would be completely incompatible with the polymer breakers that are required in the treatment fluid used in Harris et al. For example, polymer-breaking enzymes are likely to be inactivated or even substantially hydrolyzed by the high pH that would be created if a treatment formulation containing solid polyester polymer, a hydroxide base and enzyme was mixed at surface ambient temperatures.

In summary, therefore, it would not be obvious to substitute a solid polymer as taught by Still et al. for the liquid ester taught by Harris et al. because there is no motivation to make this combination. To the contrary: an objective assessment of the disclosures in the two documents would lead one of ordinary skill in the art to reject the solid polymers of Still et al. as being insufficiently reactive under the conditions associated with filter cake disruption procedures, including that of Harris et al.

Still et al. teaches away from making the combination of features that would be needed to arrive at the invention

At column 1, lines 43 to 62 Still et al. discusses the problems associated with carrying out acid fracturing procedures in formations that contain acid-reactive material along the pathway to the desired delivery point “a significant distance from the wellbore”. Here it is explained that when certain prior art methods of acid fracturing are carried out, it can be difficult to avoid unwanted reactions with materials in the wellbore itself, including filter cakes.

It is quite clear from this discussion in Still et al. that the inventors' intention in obtaining their invention was to use a delayed acid in a way that prevents unwanted reactions occurring with material the treatment fluid meets on its way to the fracture. In other words, the fluids described in Still et al. are specifically intended to hydrolyze slow enough that they do not react with filter cake in a formation, but rather only release acid once they are at their intended target location in the fractures far from the wellbore. One of ordinary skill in the art would recognize that the invention of Still et al. therefore aims at avoiding the very procedure that Harris et al. aims to give effect to. Thus, Still et al. clearly teaches one of ordinary skill in the art away from using the materials disclosed in that document in a method for filter cake disruption.

In this context, it is noted that Examiner referred to column 6, lines 61 to 67 of Still et al., where it is disclosed that the solid polymer will ultimately self-destruct (i.e., hydrolyze) wherever it ends up. That location may be "deliberate" or "inadvertent", although it is emphasized at column 7, lines 1 to 6 that the "great majority" of the material ends up in the fracture, where it generates acid and thus etches the fracture faces. The small amount of material that may be inadvertently left behind elsewhere (e.g., "as a component of a filter cake") does not constitute a teaching that the solid polymer should, or indeed can, be used for disrupting filter cakes. There is no disclosure in Still et al. of actual filter cake disruption. Rather, Still et al. teaches against using a solid polymer to try to disrupt filter cakes, since its purpose is to avoid filter cake disruption and instead direct acid into fractures distant from any filter cake. Therefore the passage at column 6, lines 61 to 67 does not alter the fact that the skilled worker would not contemplate carrying out a process for disrupting filter cake using the solid polymer.

Conclusions

It is therefore submitted that the subject-matter of independent claim 41 would not have been obvious from Harris et al. in view of Still et al. Furthermore, all of the dependent claims (including claims 42-58, 60-67, 76 and 77) depend on claim 41 and therefore derive their patentability from it. Accordingly, Applicant submits that the subject-matter of these claims must also be non-obvious over Harris et al. in view of Still et al. It is therefore believed that the rejection over this combination of documents can be withdrawn.

3. Examiner has rejected claims 59 and 78 as being unpatentable over Harris et al. in view of Still et al. as applied to claim 41 above and further in view of '698 (WO 01/02698).

The discussion in the foregoing paragraphs 1 and 2 establishes that the claimed subject-matter is non-obvious over Harris et al. in view of Still et al. '698 does not remedy the deficiencies in the teaching of Harris et al. in view of Still et al. In particular, as was explained in detail in Applicant's Amendment dated July 23, 2009 (see in particular paragraph 10) in response to the Office Action issued April 30, 2009, '698 relates to a method for treating an underground reservoir, in particular to disrupt filter cake, by introducing a treatment liquid comprising a liquid ester and a non-enzyme catalyst. Thus, the fundamental deficiency in Harris et al. is shared by '698: neither document in any way suggests use of a solid polymer capable of producing organic acids when it hydrolyzes in a method of filter cake disruption. One of ordinary skill in the art could not therefore have arrived at the subject-matter of claim 41 by way of an obvious combination of Harris et al., Constien and '698.

Dependent claims 59 and 78 depend on claim 41 and therefore derive their patentability from it. Accordingly, Applicant submits that the subject-matter of claims 59 and 78 must also be non-obvious over Harris et al. in view of Still et al. and further in view of '698. It is therefore believed that the rejection over this combination of documents can be withdrawn.

Response to arguments

4&5. Applicant has noted Examiner's remarks on the arguments put forward in response to the previous Office Action. It is gratefully noted that the previous claim rejections have been withdrawn and that Examiner has noted that the ester of Harris et al. is a liquid. Applicant's response to the new claim rejections are set out in detail in the foregoing paragraphs 1&2 and 3.

Favorable reconsideration and withdrawal of the outstanding objections and rejections is believed to be in order and is respectfully requested.

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 14-1140.

HARRIS et al.
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Respectfully submitted,

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